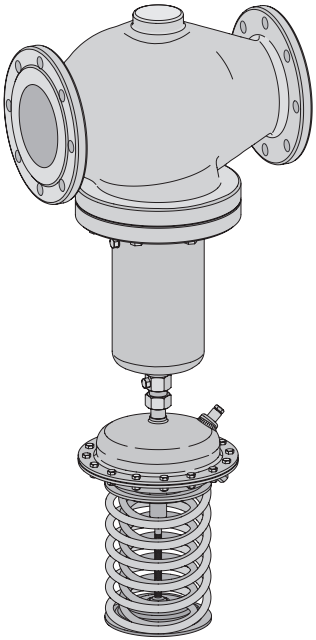
Self-operated Pressure Regulators

Type 2422/2424 Pressure Reducing Valve



Type 2422/2424 Pressure Reducing Valve

Mounting and Operating Instructions

EB 2547 EN

Edition March 2014

Definition of the signal words used in these mounting and operating instructions

DANGER!
indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING!
indicates a hazardous situation which, if not avoided, could result in death or serious injury.

NOTICE
indicates a property damage message or malfunction.

Note:
Additional information

Tip:
Recommended action

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1 General safety instructions

- The regulator must be mounted, started up or serviced by fully trained and qualified personnel only; the accepted industry codes and practices are to be observed. Make sure employees or third persons are not exposed to any danger.
- All safety instructions and warnings given in these mounting and operating instructions, particularly those concerning installation, start-up and maintenance, must be strictly observed.
- According to these mounting and operating instructions, trained personnel refers to individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the applicable standards.
- The regulators comply with the requirements of the European Pressure Equipment Directive 97/23/EC. The declaration of conformity issued for a regulator bearing the CE marking includes information on the applied conformity assessment procedure. The declaration of conformity is available on request.
- To ensure appropriate use, only use the regulator in applications where the operating pressure and temperatures do not exceed the specifications used for sizing the regulator at the ordering stage.
- The manufacturer does not assume any responsibility for damage caused by external forces or any other external factors.
- Any hazards that could be caused in the regulator by the process medium, operating pressure or by moving parts are to be prevented by taking appropriate precautions.
- Proper transport, storage, installation, operation and maintenance are assumed.

Note:
Non-electric actuators and control valve versions do not have their own potential ignition source according to the ignition risk assessment stipulated in EN 13463-1: 2009, section 5.2, even in the rare incident of an operating fault. Therefore, they do not fall within the scope of Directive 94/9/EC. For connection to the equipotential bonding system, observe the requirements specified in section 6.3 of EN 60079-14 (VDE 0165 Part 1).

2 Process medium and scope of application

Pressure regulator for liquids, gases and vapors up to 350 °C

For controlling the downstream pressure p_2 to the adjusted set point. The valve closes when the downstream pressure rises. The downstream pressure is transmitted to the actuator over a control line that must be installed on site.

The pressure regulators are not shut-off devices guaranteeing tight shut-off. When closed, these regulators can have a leakage rate of ≤ 0.05 % of the K_{VS} coefficient.

Overpressure protection must be installed in the plant.

WARNING!
Uncontrolled excess pressure in the plant can damage the diaphragm and may lead to personal injury.
The maximum permissible pressure at the actuator must not exceed the pressure specified in Table 1.

2.1 Transportation and storage

The regulator must be carefully handled, transported and stored. Protect the regulator against adverse influences, such as dirt, moisture or frost before it is installed.

When regulators are too heavy to be lifted by hand, fasten the lifting sling at a suitable place on the valve body.

WARNING!
Risk of injury due to valve falling!
Fasten the lifting sling only to the valve body and secure against slipping.

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3 Design and principle of operation

See Fig. 1 and Fig. 2.

The Type 2422/2424 Pressure Reducing Valve consists of the Type 2422 Valve and the Type 2424 Actuator. The Type 2422 Valve is available either balanced by a bellows or a diaphragm.

The pressure reducing valve is used to maintain the pressure downstream of the valve to an adjusted set point. The valve closes when the downstream pressure rises.

The medium flows through the valve in the direction indicated by the arrow. The position of the plug (3) determines the flow rate across the area released between plug and valve seat (2). The plug stem (4) with the plug is connected to the actuator stem (4.1) of the actuator (10).

The downstream pressure p_2 is adjusted over the positioning springs (11) and the set point adjuster (13). When relieved of pressure ($p_1 = p_2$), the valve is opened by the force of the positioning springs.

The downstream pressure p_2 to be controlled is tapped downstream of the valve and transmitted over the control line to the operating diaphragm (9) where it is converted into a positioning force. This force is used to move the valve plug according to the force of the positioning springs. When the force resulting from the downstream pressure p_2 rises above the adjusted set point, the valve closes proportionally to the change in pressure.

The principle of operation of the Type 2422/2424 Pressure Reducing Valve balanced by a bellows or diaphragm only differs concerning the pressure balancing. The valves balanced by a diaphragm have a balancing diaphragm (5.2) instead of a bellows (5). In both cases, the forces created by the upstream and downstream pressures that act on the valve plug are balanced out.

The valves can be supplied with flow divider St I or St III. The valve seat must be replaced on retrofitting the flow divider.

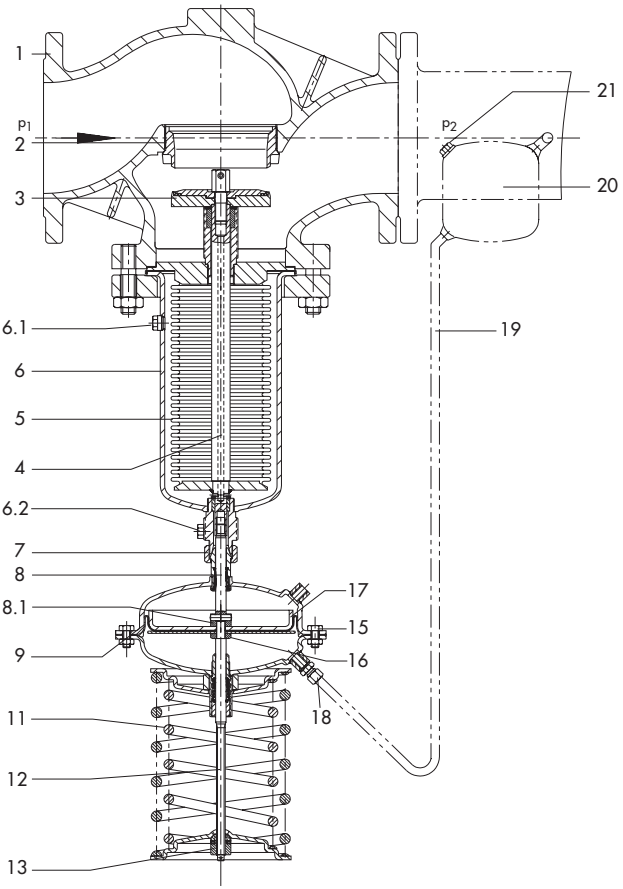
The control of **steam** and **liquids above 150 °C** is only possible with a Type 2422 Valve balanced by a bellows. In this case, condensation chamber (20) is already installed in the control line [1]. The needle valve (18) is open and lead-sealed.

Before start-up, fill the condensation chamber with process medium at the top filler opening.

[1] Only in combination with a control line kit. Otherwise, the condensation chamber must be ordered separately (see ▶ T 2595 EN).

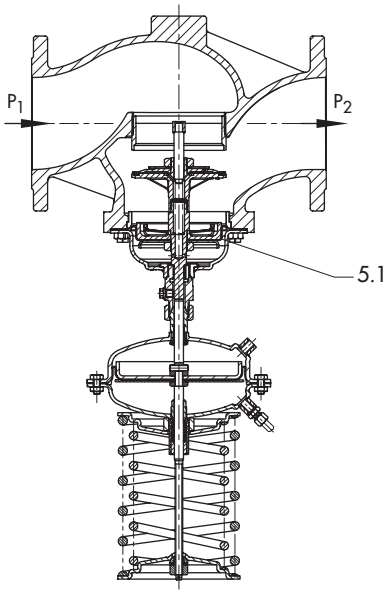
Type 2422 Valve balanced by a bellows

Type 2424 Actuator



1 Type 2422 Valve
2 Seat (exchangeable)
3 Plug
4 Plug stem
4.1 Actuator stem
5 Balancing bellows
6 Bellows housing
6.1 Vent screw (bellows housing)
6.2 Vent screw (connection to actuator)
7 Coupling nut
8 Top diaphragm stem
8.1 Nut
9 Operating diaphragm
10 Type 2424 Actuator
11 Positioning springs
13 Set point adjuster
14 Bottom diaphragm stem
15 Nuts and bolts
16 Nut
17 Diaphragm plate
18 Control line connection (for steam including screw joint with restriction and needle valve)
19 Control line
20 Condensation chamber for temperatures above 350 °C and for steam
21 Filler plug
p_1 Upstream pressure
p_2 Downstream pressure

Fig. 1: *Functional diagram of Type 2422/2424 balanced by a bellows*



5.1 Balancing diaphragm

p_1 Upstream pressure

p_2 Downstream pressure

Fig. 2: *Functional diagram of Type 2422/2424 balanced by a diaphragm*

4 Installation

See Fig. 1 and Fig. 2.

4.1 Assembly

Valve and actuator can be assembled before or after the valve has been installed in the pipeline.

➔ Relieve the positioning springs of tension by turning the set point adjuster (13).

➔ Place the actuator on the bellows housing and carefully screw it in as far as it will go. Make sure the control line connection points toward the downstream pressure side.

➔ Hold the actuator and fasten it to the bellows housing using the coupling nut (7).

4.2 Mounting position

Select the installation location making sure that the regulator is installed at a distance of at least six times the nominal size (DN) away from pipe fittings or instruments that cause flow turbulence (e.g. pipe bends, manifolds, pressure measuring points or other valves). They can change the flow conditions which may lead to an instable control process especially in applications with gases, air or steam.

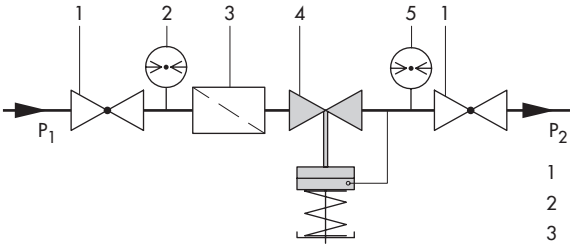
Contact SAMSON to obtain the TV-SK 17041 documentation which contains more details on installation requirements.

- Direction of flow must match the direction indicated by the arrow on the body.
- Install the regulator free of stress. If necessary, support the pipeline near to the connecting flanges. Do not attach supports directly to the valve or actuator.
- Install a strainer upstream of the regulator.
- Protect the regulator from icing up when controlling media that can freeze. If necessary, depressurize and drain the regulator and remove it from the pipeline while the plant is shut down.

4.3 Notes on installation

Install the pressure reducing valve in horizontal pipelines.

- Flush the pipeline thoroughly before installing the regulator to ensure that no impurities impair the proper functioning of the valve, above all the tight shut-off.



1	Shut-off valve
2	Upstream pressure gauge
3	Strainer
4	Type 2422/2424 Pressure Reducing Valve
5	Downstream pressure gauge
p_1	Upstream pressure
p_2	Downstream pressure

Fig. 3: *Typical application*

Mounting position

Valve balanced by a bellows/diaphragm

– Actuator facing downward

Pressure testing of the plant · The pressure must not exceed the maximum permissible pressure of the regulator and plant on testing the pressure of the plant when the regulator is already installed. An excessive test pressure can damage the operating diaphragm in the actuator.

WARNING!
Uncontrolled excess pressure in the plant can damage the diaphragm and may lead to personal injury.
The maximum permissible pressure at the actuator must not exceed the pressure specified in Table 1.

Table 1: *Max. perm. pressure at actuator*

Actuator area	Max. perm. pressure
640 cm²	1.5 bar
320 cm²	3 bar

To prevent damage to the diaphragm, take one of following precautions:

– Remove the regulator from the pipeline or isolate the regulator in the pipeline and install a bypass (see Fig. 3) or
– Detach the control line and seal the openings with end plugs or
– Install a shut-off valve in the control line.

4.4 Control line, condensation chamber and needle valve

Control line · A control line must be provided at the site of installation, e.g. a ⅜" pipe for steam or an Ø8 x 1 or Ø6 x 1 mm copper pipe for air/water.

Connect the control line to the downstream line (p_2) at least one meter away from the valve outlet. If a manifold is located downstream of the pressure reducing valve, connect the valve to the manifold, even if it is several meters away. If the downstream line behind the valve is extended by a conical expansion piece, connect the control line in the expanded section of the line. Weld the control line at the side in the middle of the pipe, inclining at a ratio of approximately 1:10 up to the condensation chamber.

Weld the line coming from the pressure tapping point to the ⅜" pipe socket on the chamber. Install the condensation chamber at the highest point of the pipeline. Consequently, the control line between condensation chamber and actuator must also be installed with a downward slope. In this case, use a ⅜" pipe with screw fittings.

If the control line connection is located below the middle of the valve outlet flange, arrange the condensation chamber at the same level as the outlet flange. In this case, use a pipe which is at least ½" in size for the control line from the tapping point to the condensation chamber.

If the control line is connected above the middle of the valve outlet flange, install the condensation chamber at the same level as the

downstream pressure tapping point. The additional pressure of the condensate head must be compensated for by adjusting the set point to a higher value.

Control line kit · A control line kit for tapping pressure directly at the valve body is available as an accessories part from SAMSON (for set points ≥ 0.8 bar).

Condensation chamber · A condensation chamber is required for liquids **above 150 °C** as well as for **steam.** The mounting position of the condensation chamber is indicated by an adhesive label on the chamber itself as well as by an arrow and the word "top" stamped on the top of the chamber.

This mounting position must be adhered to; otherwise the safe functioning of the pressure reducing valve cannot be guaranteed.

Needle valve · If the regulator tends to hunt, install a needle valve at the control line connection (18) in addition to the standard SAMSON screw joint with restriction.

4.5 Strainer

Install the strainer upstream of the pressure reducing valve (see Fig. 3).

– The direction of flow must correspond to the arrow on the body.
– The filter element must be installed to hang downwards or sideways for applications with steam.

Tip:
Remember to leave enough space to remove the filter element.

4.6 Shut-off valve

Install a hand-operated shut-off valve both upstream of the strainer and downstream of the regulator. This allows the plant to be shut down for cleaning and maintenance, and when the plant is not used for longer periods of time (see Fig. 3).

4.7 Pressure gauges

Install a pressure gauge both upstream and downstream of the regulator to monitor the pressures prevailing in the plant (see Fig. 3).

Install the pressure gauge on the downstream side behind the downstream pressure tapping point.

5 Operation

See Fig. 1 and Fig. 2.

5.1 Start-up

First start up the regulator after mounting all parts. Make sure the control line is open and correctly connected.

Fill the plant **slowly** with the process medium. Avoid pressure surges. Open the shut-off valves first on the upstream pressure side. Afterwards, open all the valves on the consumer side (downstream of the regulator).

Regulation of steam

Observe the following points for applications with steam:

– Before start-up, all pipes conveying the process medium must be completely drained and dry (to prevent steam hammering).
– Before start-up, fill the condensation chamber with water at the filler opening (21) until it overflows. Reattach plug.
– **Slowly** start up the plant and allow time for the pipes and valves to warm up.

Air and condensate must be allowed to drain from the plant. Install steam trap (e.g. SAMSON Type 13 E) or air vent for steam-operated systems (e.g. SAMSON Type 3) at a suitable location.

Regulation of liquids

To start up the pressure reducing valve, open shut-off valves slowly. When a 640 cm² actuator is used, unscrew vent screw (6.1) to allow any air to escape and then retighten screw.

For temperatures above 150 °C, first fill the condensation chamber with the process medium.

5.2 Adjusting the set point

Adjust the required downstream pressure by turning the set point adjuster (13).

Turn clockwise ↻

– The downstream pressure is increased (higher pressure set point)

Turn counterclockwise ↺

– The downstream pressure is reduced (lower pressure set point)

When the force resulting from the downstream pressure p_2 rises above the adjusted set point, the valve closes proportionally to the change in pressure.

Tip:
Monitor the adjusted set point pressure at the pressure gauge on the downstream pressure side.

Changing the set point range

The set point range is determined by the size of the actuator and its positioning springs. The set point range can only be changed by exchanging the entire actuator assembly. Therefore, we recommend contacting us if you want to change the set point range.

5.3 Decommissioning

Close first the shut-off valve on the upstream side of the valve and then on the downstream side of the valve.

6 Maintenance and troubleshooting

If the downstream pressure deviates considerably from the set point, check the control line for blockage and check the diaphragm for leakage.

In case of other causes, such as a damaged seat or plug, we recommend contacting SAMSON's customer service (see section 8).

If the diaphragm is damaged, proceed as described in section 6.1.

WARNING!
Hot process medium can escape uncontrolled on dismantling the regulator. Risk of scalding.
Allow the regulator to cool down before depressurizing and draining it and remove it from the pipeline.

6.1 Replacing the operating diaphragm

See Fig. 1 and Fig. 2.

Shut down the plant by slowly closing the shut-off valves. Depressurize the relevant section of the pipeline and, if necessary, drain it as well.

The actuator can be removed from the valve without having to remove the valve from the pipeline. However, in this case, do not forget that the actuator cone seals off the bellows housing. Consequently, the process medium will drain out of the valve on removing the actuator.

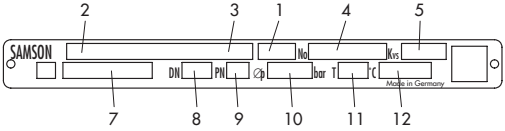
1. Relieve the spring assembly of tension by turning the set point adjuster (13) counterclockwise.
2. Unscrew the control line and clean it.
3. Undo the coupling nut (7) and remove the actuator.
4. Unscrew the set point adjuster (13). Remove bearing, bushing, spring(s) and spring plate.
5. Undo nuts and bolts (15). Lift the top cover plate off the actuator stem.
6. Pull the diaphragm stems together with the diaphragm plates and the diaphragm out of the lower diaphragm case.
7. Hold the bottom nut (16) stationary using a socket wrench and unscrew the top diaphragm stem by loosening the nut (8.1) (the nut is sealed with paint!).
8. Take off the top diaphragm plate (17). Replace the operating diaphragm (9) with a new one.

Proceed in the reverse order to reassemble the regulator. For start-up, proceed as described in section 5.1.

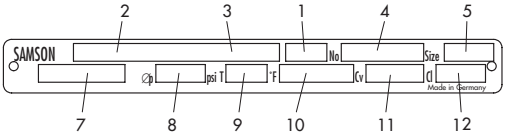
7 Nameplate

Nameplates are attached to the valve and the actuator.

Valve nameplate



DIN version



ANSI version

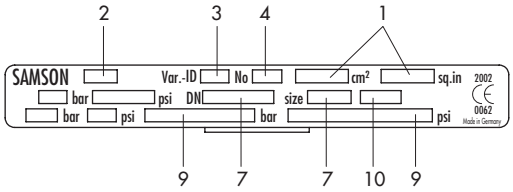
DIN version

1 Valve type
2 Model number with index
3 Configuration ID (Var.-ID)
4 Order number or date
5 K_{VS} coefficient
7 Spring force/set point range
8 Nominal size
9 Nominal pressure
10 Perm. differential pressure
11 Perm. temperature
12 Body material

ANSI version

5 Valve size
7 Spring force
8 Perm. differential pressure
9 Perm. temperature (°F)
10 Body material
11 C_V coefficient (K_{VS} x 1.17)
12 ANSI Class (pressure rating)

Actuator nameplate



DIN/ANSI version

1 Effective area (DIN/ANSI)
2 Type
3 Configuration ID (Var.-ID)
4 ID number
7 Valve size (DIN/ANSI)
9 Set point range (DIN/ANSI)
10 Diaphragm material

Fig. 4: *Nameplates*

8 Customer service

If malfunctions or defects occur, contact the SAMSON After-sales Service Department for support.

The addresses of SAMSON AG, its subsidiaries, representatives and service facilities worldwide can be found on the SAMSON website, in all SAMSON product catalogs or on the back of these Mounting and Operating Instructions.

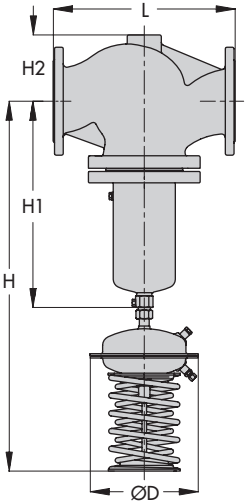
Please send your inquiries to: service@samson.de

To assist diagnosis, specify the following details (see section 7):

- Type and nominal size of the valve
- Model number and configuration ID (Var.-ID)
- Order number or date
- Upstream and downstream pressure
- Temperature and process medium
- Min. and max. flow rate in m^3/h
- Is a strainer installed?
- Installation drawing showing the exact location of the regulator and all the additionally installed components (shut-off valves, pressure gauge, etc.)

9 Dimensions

Type 2422/2424 · **Balanced by a bellows**



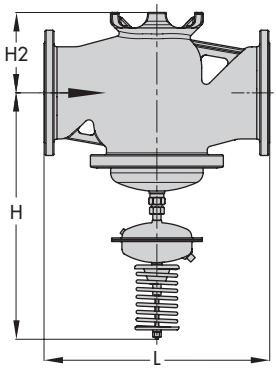
Dimensions in mm and weights in kg · The values in parentheses apply to temperatures from 220 to 350 °C

Nominal size			**DN 125**	**DN 150**	**DN 200**	**DN 250**
Length L			400 mm	480 mm	600 mm	730 mm
Height H1			460 (600) mm	590 (730) mm	730 (870) mm	
Height H2			145 mm	175 mm	235 mm	260 mm
Set point ranges in bar	0.05 to 0.25	Height H	990 (1130) mm	1120 (1260)	1260 (1400) mm	
		Actuator	ØD = 380 mm, A = 640 cm²			
	0.1 to 0.6	Height H	990 (1130) mm	1120 (1260) mm	1260 (1400) mm	
		Actuator	ØD = 380 mm, A = 640 cm²			
	0.2 to 1.0	Height H	990 (1130) mm	1120 (1260) mm	1260 (1400) mm	
		Actuator	ØD = 380 mm, A = 640 cm²			
	0.5 to 1.5	Height H	910 (1050) mm	1040 (1180) mm	1180 (1320) mm	
		Actuator	ØD = 285 mm, A = 320 cm²			
	1 to 2.5	Height H	910 (1080) mm	1070 (1210) mm	1180 (1350) mm	
		Actuator	ØD = 285 mm, A = 320 cm²			
	Weight [1] based on cast iron, PN 16, approx.					
	0.05 to 1.0		135 kg	116 kg	286 kg	296 kg
	0.5 to 1.5/1 to 2.5		125 kg	110 kg	280 kg	290 kg

[1] +10 % for cast steel, spheroidal graphite iron and forged steel

Fig. 5: *Dimensions · Type 2422/2424 ·* ***Balanced by a bellows***

Type 2422/2424 · **Balanced by a diaphragm**



Dimensions in mm and weights in kg

Nominal size	**DN 125**	**DN 150**	**DN 200**	**DN 250**
Length L	400 mm	480 mm	600 mm	730 mm
Height H	720 mm	745 mm	960 mm	960 mm
Height H2	145 mm	175 mm	260 mm	260 mm
Weight (actuator with valve), approx.				
0.05 to 1 bar	80 kg	93 kg	238 kg	248 kg
0.5 to 2.5 bar	75 kg	87 kg	232 kg	242 kg

Fig. 6: *Dimensions · Type 2422/2424 ·* ***Balanced by a diaphragm***

10 Technical data

Type 2422 Valve					
Nominal pressure		PN 16, 25 or 40			
Nominal size		DN 125	DN 150	DN 200	DN 250
Max. perm. temperature	Valve balanced by a bellows	Metal seal: max. 350 °C · PTFE soft seal: max. 220 °C · EPDM or FPM soft seal: max. 150 °C · NBR soft sealing: max. 80 °C [1]			
	Valve balanced by a diaphragm	EPDM soft seal, max. 150 °C			
Leakage class according to IEC 60534-4		≤ 0.05 % of K_{VS} coefficient			
Type 2424 Actuator					
Set point ranges		0.05 to 0.25 bar · 0.1 to 0.6 bar · 0.2 to 1 bar 0.5 to 1.5 bar ·1 to 2.5 bar [2]			
Max. perm. pressure at actuator	Effective diaphragm area	320 cm²		640 cm²	
	Pressure	3 bar		1.5 bar	
Max. permissible temperature		Gases 350 °C, however, max. 80 °C at the actuator [1] · Liquids 150 °C, with condensation chamber max. 350 °C · Steam with condensation chamber max. 350 °C			

1) For oxygen max. 60 °C

2) Set point ranges above 2.5 bar, see ▶ T 2552 EN · Type 2333 Pressure Reducing Valve

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Conversion from chromate coating to iridescent passivation

Conversion from chromate coating to iridescent passivation

We at SAMSON are converting the surface treatment of passivated steel parts in our production. As a result, you may receive a device assembled from parts that have been subjected to different surface treatment methods. This means that the surfaces of some parts show different reflections. Parts can have an iridescent yellow or silver color. This has no effect on corrosion protection.

For further information, go to ▶ www.samson.de/chrome-en.html